

CLAIMS

What is claimed is:

1 1. A lever-actuator for fiber optic modules, the lever-
2 actuator comprising:
3 a lever arm;
4 a pivoting fastener coupled to one end of the lever arm;
5 and
6 an actuating tab coupled to the lever arm.

1 2. The lever-actuator of claim 1 wherein
2 the lever-actuator rotates to cause a second actuator to
3 disengage a fiber optic module from a cage assembly.

1 3. The lever-actuator of claim 2 wherein the actuating
2 tab rotates with the lever arm to cause the second actuator to
3 disengage.

1 4. The lever-actuator of claim 1 wherein the actuating
2 tab prevents the lever arm from rotating further once it
3 reaches a limit point.

1 5. The lever-actuator of claim 1 further comprising:

2 a sliding-actuator which slides to disengage a fiber
3 optic module from a cage assembly when the lever-actuator is
4 rotated.

1 6. The lever-actuator of claim 1 wherein the lever-
2 actuator permits arranging multiple fiber optic modules in a
3 belly-to-belly configuration without obstructing adjacent
4 lever-actuators.

1 7. The lever-actuator of claim 6 wherein with the
2 belly-to-belly configuration, two lever-actuators are located
3 in proximity to each other along a common surface between two
4 fiber optic modules.

1 8. The lever-actuator of claim 1 wherein the pivoting
2 faster includes a pin to rotationally couple the lever-
3 actuator to a fiber optic module.

1 9. The lever-actuator of claim 1 wherein the pivoting
2 faster includes a plurality of pins to rotationally couple the
3 lever-actuator to a fiber optic module.

1 10. The lever-actuator of claim 1 wherein the pivoting
2 faster includes a conical retainer.

1 11. The lever-actuator of claim 1 wherein the pivoting
2 fastener includes holes to receive one or more pins to couple
3 the lever-actuator to a fiber optic module.

1 12. The lever-actuator of claim 1 further comprising:
2 a pull-arm.

1 13. The lever-actuator of claim 12 wherein,
2 the pull-arm is a semi-circular ring.

1 14. The lever-actuator of claim 12 wherein,
2 the pull-arm is a tab.

1 15. The lever-actuator of claim 12 wherein,
2 the pull-arm is a bail-latch.

1 16. A de-latch mechanism for fiber optic modules
2 comprising:
3 a lever-arm actuator with a pivot point; and
4 a sliding actuator, wherein rotating the lever-arm
5 actuator about its pivot point causes the sliding actuator to
6 slide and to release a fiber optic module from a cage
7 assembly.

1 17. The de-latch mechanism of claim 16 wherein the
2 lever-arm actuator includes
3 an actuating tab coupled to the lever-arm actuator,
4 wherein the actuating tab rotates when the lever-arm actuator
5 is rotated about its pivot point to cause the second actuator
6 to slide and release a fiber optic module from a cage
7 assembly.

1 18. The de-latch mechanism of claim 17 wherein the
2 actuating tab rotates about the same axis as the lever-arm
3 actuator when the lever-arm actuator is rotated.

1 19. The de-latch mechanism of claim 16 wherein pulling
2 the lever-arm actuator causes a fiber optic module to withdraw
3 from a cage assembly.

1 20. The de-latch mechanism of claim 16 further
2 comprising:
3 a pivot fastener at the pivot point of the lever-arm
4 actuator to rotationally couple the lever-arm actuator to a
5 fiber optic module.

1 21. The de-latch mechanism of claim 20 wherein the pivot
2 fastener includes a pin.

1 22. The de-latch mechanism of claim 20 wherein the pivot
2 fastener includes a hole.

1 23. The de-latch mechanism of claim 16 wherein the de-
2 latch mechanism permits arranging multiple fiber optic modules
3 in a belly-to-belly configuration without obstructing adjacent
4 de-latch mechanism.

1 24. A fiber optic module comprising:
2 a nose receptacle including
3 a fiber optic cable receptacle to receive one
4 or more fiber optic cable plugs,
5 a lever-actuator to release the fiber optic
6 module from a cage assembly using a rotational
7 action;
8 a second actuator coupled to the pull-actuator,
9 the second actuator to release a keeper from a latch
10 to release the fiber optic module in response to a
11 rotational action on the lever-actuator;
12 and
13 a printed circuit board including one or more
14 electro-optic transducers to convert optical signals into
15 electrical signals or electrical signals into optical signals.

1 25. The fiber optic module of claim 24 wherein,
2 the fiber optic module is a small form pluggable (SFP)
3 fiber optic module and the cage assembly is a small form
4 pluggable (SFP) cage assembly.

1 26. The fiber optic module of claim 24 further
2 comprising:
3 a housing to couple to the nose receptacle and cover the
4 printed circuit board.

1 27. The fiber optic module of claim 26 wherein,
2 the housing is shielded to protect the printed circuit
3 board from electromagnetic interference.

1 28. The fiber optic module of claim 24 wherein,
2 the lever-actuator includes one or more pins to
3 rotationally engage the nose receptacle.

1 29. The fiber optic module of claim 24 wherein,
2 the lever-actuator includes one or more holes to
3 rotationally engage the nose receptacle.

1 30. The fiber optic module of claim 24 wherein,
2 the second-actuator slides to release the fiber optic
3 module from the cage assembly.

1 31. The fiber optic module of claim 24 wherein,
2 the second-actuator includes
3 grooves to slideably couple the second-actuator to the
4 nose receptacle.

1 32. The fiber optic module of claim 24 wherein,
2 the second-actuator includes
3 rails to slideably coupled the second-actuator to the
4 nose receptacle.

1 33. The fiber optic module of claim 24 wherein,
2 the lever-actuator includes
3 an orientation indicator to indicate the fiber optic
4 module which the lever-actuator releases.

1 34. The fiber optic module of claim 24 wherein,
2 the lever-actuator includes

3 a pull-arm.

1 35. The lever-actuator of claim 34 wherein,
2 the pull-arm is a semi-circular ring.

1 36. The lever-actuator of claim 34 wherein,
2 the pull-arm is a rectangular ring.

1 37. The lever-actuator of claim 34 wherein,
2 the pull-arm is a tab.

1 38. A fiber optic module comprising:
2 a bail-latch to disengage and withdraw the fiber optic
3 module from a cage assembly; and
4 one or more electro-optic transducers to convert optical
5 signals into electrical signals or electrical signals into
6 optical signals.

1 39. The fiber optic module of claim 38 wherein
2 the fiber optic module is a small form factor pluggable
3 (SFP) fiber optic module and the cage assembly is a small form
4 factor pluggable (SFP) cage assembly.

1 40. The fiber optic module of claim 38 wherein
2 the bail-latch is activated to disengage and withdraw the
3 fiber optic module by placing the bail latch in a horizontal
4 position and pulling backward on the bail latch.

1 41. The fiber optic module of claim 38 wherein
2 the bail latch is coupled to the fiber optic module using
3 a pivoting pin.

1 42. The fiber optic module of claim 41 wherein
2 the bail-latch is activated to disengage and withdraw the

3 fiber optic module by causing the bail latch to pivot around
4 the pivot pin into a horizontal position and pulling backward
5 on the bail latch.

1 43. The fiber optic module of claim 38 further
2 comprising:

3 a slide actuator having a surface butting against a tab
4 of the bail-latch at one end and at least one ramp or lifter
5 at an opposite end.

1 44. The fiber optic module of claim 43 wherein
2 the at least one ramp or lifter of the slide actuator
3 pushes a latch of a cage assembly to disengage the fiber optic
4 module from the cage assembly.

1 45. The fiber optic module of claim 43 further
2 comprising:
3 a boss.

1 46. The fiber optic module of claim 43 wherein
2 the slide-actuator further includes
3 grooves to slideably engage rails of the fiber optic
4 module.

1 47. The fiber optic module of claim 43 wherein
2 the slide-actuator further includes
3 rails to slideably engage grooves of the fiber optic
4 module.

1 48. The fiber optic module of claim 38 further
2 comprising:
3 a boss.

1 49. The fiber optic module of claim 38 wherein

2 the bail-latch is formed of metal.

1 50. The fiber optic module of claim 38 wherein
2 the bail-latch is formed of plastic.

1 51. The fiber optic module of claim 38 further
2 comprising:
3 a pivoting pin to rotationally couple the bail-latch to
4 the fiber optic module,
5 a sliding actuator having a butt surface at one end and
6 at least one ramp at an opposite end, and
7 the bail-latch further includes
8 a tab to abut against the butt surface of the sliding
9 actuator.

1 52. The fiber optic module of claim 51 wherein
2 the bail-latch is activated to disengage the fiber optic
3 module by moving the bail latch into a horizontal position
4 causing the tab to press against the butt surface and slide
5 the sliding actuator in the fiber optic module.

1 53. The fiber optic module of claim 51 wherein
2 the bail latch further includes,
3 a pair of tabs at opposite sides each including an
4 opening to couple to the pivoting pin.

1 54. The fiber optic module of claim 38 wherein
2 the bail latch further includes,
3 a pair of pivot points at opposite sides each
4 including a point to couple to the fiber optic module to be
5 rotationally coupled thereto.

1 55. A fiber optic module comprising:
2 means for converting optical signals into electrical

3 signals or electrical signals into optical signals; and
4 means for disengaging the fiber optic module from a cage
5 assembly by rotating a lever-actuator.

1 56. The fiber optic module of claim 55 further
2 comprising:
3 means for withdrawing the fiber optic module by pulling
4 on the lever-actuator.

1 57. The fiber optic module of claim 56 wherein the means
2 for disengaging also provides a means for withdrawing.

1 58. The fiber optic module of claim 55 further
2 comprising:
3 means for pivotally disengaging the fiber optic module
4 from a cage assembly when the lever-actuator is rotated.

1 59. The fiber optic module of claim 55 further
2 comprising:
3 means for coupling the disengaging means to the fiber
4 optic module.

1 60. The fiber optic module of claim 55 further
2 comprising:
3 means for indicating the fiber optic module which the
4 disengaging means releases.

1 61. A method for disengaging and withdrawing a fiber
2 optic module from a cage assembly comprising:
3 rotating a lever-actuator to disengage the fiber optic
4 module from the cage assembly; and
5 pulling on the lever-actuator to withdraw the fiber optic
6 module from the cage assembly.

1 62. The method of claim 61 further comprising:
2 releasing the lever-actuator if the fiber optic module
3 has been released from the cage assembly.

1 63. A configuration of fiber optic modules having one or
2 more electro-optic transducers, the configuration comprising:
3 a printed circuit board having a first side and a second
4 side;
5 a first cage coupled to the first side of the printed
6 circuit board to receive a first fiber optic module having a
7 first bail latch delatching mechanism; and
8 a second cage coupled to the second side of the printed
9 circuit board to receive a second fiber optic module having a
10 second bail latch delatching mechanism, the second cage
11 aligned in parallel to the first cage such that a first belly
12 of the first fiber optic module is adjacent a second belly of
13 the second fiber optic module with adequate spacing to allow
14 the first bail latch delatching mechanism and the second bail
15 latch delatching mechanism to rotate to a disengaged position.

1 64. The configuration of claim 63 wherein,
2 the first belly of the first fiber optic module being
3 adjacent to the second belly of the second fiber optic module
4 provides for increased density.

1 65. A de-latch mechanism for fiber optic modules
2 comprising:
3 a lever-arm actuator with a pivot point;
4 a spring coupled to the lever-arm actuator around the
5 pivot point, the spring to apply a bias force to the lever-arm
6 actuator; and
7 a sliding actuator, wherein rotating the lever-arm
8 actuator about its pivot point causes the sliding actuator to
9 slide thereby releasing a fiber optic module from a cage

10 assembly.

1 66. The de-latch mechanism of claim 65 wherein the
2 lever-arm actuator includes
3 an actuating tab coupled to the lever-arm actuator,
4 wherein the actuating tab rotates when the lever-arm actuator
5 is rotated about its pivot point thereby causing the second
6 actuator to slide and release a fiber optic module from a cage
7 assembly.

1 67. The de-latch mechanism of claim 66 wherein
2 the actuating tab rotates about the same axis as the
3 lever-arm actuator when the lever-arm actuator is rotated.

1 68. The de-latch mechanism of claim 65 wherein
2 pulling the lever-arm actuator causes a fiber optic
3 module to withdraw from a cage assembly.

1 69. The de-latch mechanism of claim 65 wherein
2 the spring is a biasing spring, a tension spring, a
3 torsion spring, a wind-up spring, or a coil spring to apply
4 the bias force.

1 70. A fiber optic module comprising:
2 a nose receptacle including
3 a fiber optic cable receptacle to receive one
4 or more fiber optic cable plugs,
5 a lever-actuator to release the fiber optic
6 module from a cage assembly using a rotational
7 action,
8 a spring to bias the lever-actuator to an
9 engaged position, and
10 a second actuator coupled to the lever-
11 actuator, the second actuator to release a keeper

12 from a latch to release the fiber optic module in
13 response to a rotational action on the lever-
14 actuator;
15 and
16 a printed circuit board including one or more electro-
17 optic transducers to convert optical signals into electrical
18 signals or electrical signals into optical signals.

1 71. The fiber optic module of claim 70 wherein,
2 the fiber optic module is a small form pluggable (SFP)
3 fiber optic module and the cage assembly is a small form
4 pluggable (SFP) cage assembly.

1 72. The fiber optic module of claim 70 further
2 comprising:
3 a housing to couple to the nose receptacle and cover the
4 printed circuit board.

1 73. The fiber optic module of claim 72 wherein,
2 the housing is shielded to protect the printed circuit
3 board from electromagnetic interference.

1 74. The fiber optic module of claim 70 wherein,
2 the lever-actuator includes one or more pins to
3 rotationally engage the nose receptacle.

1 75. The fiber optic module of claim 70 wherein,
2 the lever-actuator includes one or more holes to
3 rotationally engage the nose receptacle.

1 76. The fiber optic module of claim 70 wherein,
2 the lever-actuator includes one or more pins to
3 rotationally engage the nose receptacle.

1 77. The fiber optic module of claim 70 wherein,
2 the second-actuator slides to release the fiber optic
3 module from the cage assembly.

1 78. The fiber optic module of claim 70 wherein,
2 the second-actuator includes
3 grooves to slideably coupled the second-actuator to the
4 nose receptacle.

1 79. The fiber optic module of claim 70 wherein,
2 the second-actuator includes
3 rails to slideably coupled the second-actuator to the
4 nose receptacle.

1 80. The fiber optic module of claim 70 wherein
2 the spring is a biasing spring, a tension spring, a
3 torsion spring, a wind-up spring, or a coil spring to apply
4 the bias force.

1 81. A fiber optic module comprising:
2 a bail-latch to disengage and withdraw the fiber optic
3 module from a cage assembly;
4 a spring to bias the bail-latch into an engaged position;
5 and
6 one or more electro-optic transducers to convert optical
7 signals into electrical signals or electrical signals into
8 optical signals.

1 82. The fiber optic module of claim 81 wherein
2 the fiber optic module is a small form factor pluggable
3 (SFP) fiber optic module and the cage assembly is a small form
4 factor pluggable (SFP) cage assembly.

1 83. The fiber optic module of claim 81 wherein
2 the bail-latch is activated to disengage and withdraw the
3 fiber optic module by placing the bail latch in a horizontal
4 position and pulling backward on the bail latch.

1 84. The fiber optic module of claim 81 wherein
2 the bail latch is coupled to the fiber optic module using
3 a pivoting pin.

1 85. The fiber optic module of claim 84 wherein
2 the bail-latch is activated to disengage and withdraw the
3 fiber optic module by causing the bail latch to pivot around
4 the pivot pin into a horizontal position and pulling backward
5 on the bail latch.

1 86. The fiber optic module of claim 81 further
2 comprising:
3 a slide actuator having a surface butting against a tab
4 of the bail-latch and at least one ramp or lifter at an
5 opposite end.

1 87. The fiber optic module of claim 86 wherein
2 the at least one ramp or lifter of the slide actuator
3 pushes a latch of a cage assembly to disengage the fiber optic
4 module from the cage assembly.

1 88. The fiber optic module of claim 86 further
2 comprising:
3 a boss.

1 89. The fiber optic module of claim 81 further
2 comprising:
3 a pivoting pin to rotationally couple the bail-latch to

4 the fiber optic module,
 5 a sliding actuator having a butt surface at one end and
 6 at least one ramp at an opposite end, and
 7 the bail-latch further includes
 8 a tab to abut against the butt surface of the sliding
 9 actuator.

1 90. The fiber optic module of claim 89 wherein
 2 the bail-latch is activated to disengage the fiber optic
 3 module by moving the bail latch into a horizontal position
 4 causing the tab to press against the butt surface and slide
 5 the sliding actuator in the fiber optic module.

1 91. The fiber optic module of claim 89 wherein
 2 the bail latch further includes,
 3 a pair of tabs at opposite sides each including an
 4 opening to couple to the pivoting pin.

1 92. The fiber optic module of claim 81 wherein
 2 the bail latch further includes,
 3 a pair of pivot points at opposite sides each
 4 including a point to couple to the fiber optic module to be
 5 rotationally coupled thereto.

1 93. The fiber optic module of claim 81 wherein
 2 the spring is a biasing spring, a tension spring, a
 3 torsion spring, a wind-up spring, or a coil spring to apply
 4 the bias force.